IJBPAS, October, 2025, 14(10): 5218-5234

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

POLYHERBAL SHAMPOO FOR HAIR GROWTH, CONDITIONING, AND HAIR MANAGEMENT: FORMULATION, EVALUATION, AND COMPARISON TO MARKETED PRODUCT

ASTHANA GS*, ANUSHA G., ABHINAV U. AND SIDDHARTHA REDDY L.

Department of Pharmaceutics, Gokaraju Rangaraju College of Pharmacy, Hyderabad, India

***Corresponding Author: Dr. Gyati Shilakari Asthana: E Mail: gyatimmu@gmail.com**

Received 25th April 2024; Revised 28th Aug. 2024; Accepted 25th Sept. 2024; Available online 1st Oct. 2025

https://doi.org/10.31032/IJBPAS/2025/14.10.9423

ABSTRACT

Objective: To formulate and evaluate multi-purpose herbal shampoo using Bhringraj powder, Henna, Lemon, Amla, Reetha, Neem, Tulsi. Green tea leaves, Aloe vera, Shikakai, Orange peel powder, Onion peel powder, Fenugreek powder, Black cumin seeds, Coffee powder, Hibiscus powder, Curry leaves and Triphala.

Methods: Various multipurpose herbal shampoos were prepared using herbal ingredients and Gelatin, Tragacanth gum, Coconut oil, and Castor oil. Then decoction of these herbs and a small amount of preservative (methylparaben) were added. All the developed herbal shampoos were evaluated according to various parameters: appearance, pH, washability, solid content percentage, and foaming index. Antimicrobial activity against Gram-positive, Gram-negative bacteria and fungi was determined and compared with marketed formulation.

Results: Developed multipurpose herbal shampoos (formulations F1, F2, and F3) showed good appearance, adequate percentage solid content and pH. The formulations did not show any skin irritation. All three formulations F1, F2 and F3 were found to be stable at room temperature for one month. Developed herbal shampoos show good antibacterial and antifungal activity against Gram-positive (*Staphylococcus aureus*), Gram-negative (*E. coli*) bacteria and *Candida albicans* and *Aspergillus niger.* F3 formulation shows comparative results to the marketed formulation.

Conclusion: All developed herbal shampoos that show good antimicrobial activity and formulations are stable at room temperature and would be further evaluated for preclinical studies.

Keywords: Multipurpose polyherbal shampoo, Herbal ingredients, Preparation, Evaluation, Antimicrobial activity

INTRODUCTION

Shampoo is a hair care product that comes in liquid or cream form. It contains soap or detergent and is used to cleanse the hair. Shampoo is designed to remove dirt and product buildup from the hair without stripping away too many natural oils, which can lead to dryness and frizz. It is the most commonly used method of cleaning the scalp and hair **[1]**.

Herbal shampoo

Herbal shampoo cleanses, conditions, and smoothens hair, promotes hair health, and acts as anti-dandruff and removes dirt, grease, and lice. It also has many safety advantages. Herbal cosmetics have benefits like being non-toxic, reducing allergic reactions, and having many ingredients that are useful over time.

Herbal shampoos are better than synthetic ones in terms of effectiveness and safety. A more drastic strategy to make herbal shampoo more widely used would be to alter consumer expectations by placing more of a focus on efficacy and safety in shampoos. Typically, shampoos contain 10 to 30 ingredients **[2]**.

TYPES OF SHAMPOOS

There are many types of shampoos described in the below section **[3]**.

1. Powder shampoo: Powder shampoo is a type of shampoo that comes in the form of dry powder. It was originally made from dry soaps, but nowadays, dry synthetic detergents are used in its preparation

2. Liquid shampoo: Liquid shampoo is the most common type of shampoo. It is usually clear and made with a low cloud point detergent. Some liquid shampoos may also be transparent.

3. Lotion shampoos: Lotion shampoos are a type of clear liquid cream shampoos. They use solubilizing agents

like magnesium stearate to dissolve the opacifier.

4. Jelly shampoo: Jelly shampoo is a type of shampoo that stands out from the rest. It has a distinct appearance, being transparent and thick, thanks to the inclusion of a gelling agent like cellulose. While it may not be as commonly found on store shelves as other shampoos, it is widely used in hair salons and beauty parlors for its unique qualities.

5. Keratin shampoo: Boost Your Hair Care with Keratin Oil

Infusing your shampoo (or any other hair care product) with keratin oil provides benefits that nourish and condition the hair. This makes it appear shiny and smooth. It also helps to Fight frizz, Control flyaways and protect against damage caused by styling tools such as a straightening iron or blow

6. Specialized shampoos: Specialized shampoos are designed for specific needs:

- People with dandruff
- Those with color-treated hair
- Individuals with wheat or gluten allergies
- Those who prefer using organic products
- Babies and young children (as "baby shampoo" is less irritating)
- These are the target market for specialty shampoos.

Ideal Properties of Shampoo

1. Making the hair smooth and shiny.
2. Should not irritate the scalp, skin, or eyes.
3. Create a sufficient amount of foam.
4. The dirt should be completely and effectively removed.
5. Add a pleasant fragrance to the hair.

Functions of Shampoo

1. It must effectively and completely remove dirt or soil.
2. It should wash your hair effectively.
3. Rinse with water to easily remove it.
4. It should produce enough foam to satisfy the user.
5. There should be no side effects or irritation of the skin or eyes.
6. It should leave a pleasant fragrance in the hair **[4]**.

Benefits of Herbal Shampoo over Chemical Shampoo

Chemical shampoos may appear to improve hair texture along the length; however they eventually damage the roots, causing:

1. Early graying and premature aging of hair.
2. Dryness and itching of the scalp.
3. Split ends and excessive hair loss.

To address these issues, consider using an herbal shampoo to replenish nutrients and prevent further damage. This herbal formulation has the following advantages: -

1. No side effects
2. Stable.
3. Safer than commercial shampoos.
4. No surfactants (e.g., SLS)
5. Free of synthetic additives.

With a focus on safety and efficacy, the aim was to create a multi-purpose herbal shampoo with natural ingredients that would minimize production costs and avoid the risks associated with chemical ingredients **[5, 6]**.

Function of ingredients

Various ingredients are used in the herbal shampoos, and their functions are explained below **[7, 8]**.

Table 1: Herbal ingredients description

S. No.	Name of herb/ingredients	Biological Source	Family	Use
01	Shikakai	Dried pods of Acacia concinna.	Mimosaceae	Foam base, cleansing agent, anti-dandruff. Enhances hair shine and leaves it soft and smooth after washing.
02	Reetha	Dried fruits of *Sapindus mukorossi*.	Sapindaceae	Detergent, cleansing agent and antidandruff.
03	Neem	dried *Azadirachta indica* leaves	Miliaceae	Prevents hair dryness, flaking and anti-dandruff activity
04	Amla	Dried ripe fruits of *Embelica officinalis*	Euphorbiaceae	Hair darkening and growth promoter.
05	Tulsi	Fresh and dried leaves of *Ocimum sanctum* Linn	Lamiaceae	Anti-bacterial and anti-fungal properties
06	Aloe vera	The juice of the aloe plant is extracted through an incision. the underside of various aloe species' leaves	Asphodelaceae	Anti-fungal activity and reduce dandruff, raise hair growth, and balance the pH of the scalp
07	Henna	dried leaves of *Lawsonia inermis* L	Lythraceae	Protects natural hair colour, conditions hair and increase hair growth
08	Green tea leaves	unoxidized leaves of *Camellia sinensis* bush	Theaceae	Treats Split Ends and has scalp-nurturing qualities
09	Hibiscus	flowering part of *Hibiscus sabdariffa*	Meliaceae	keep scalp healthy and prevents from dandruff
10	Fenugreek	dried seeds of *Trigonella foenum*-graecum	Fabaceae	stimulate the barrier of moisturizer in hair strands, function as a simonizing agent, and be used to get rid of dandruff
11	Onion peel	obtained from the peel of *Onion cepa*	Liliaceae	promotes hair growth and removes dandruff from scalp
12	Orange peel	dried outer part of *Citrus sinensis* Linn	Rutaceae	moisturize scalp, prevent dandruff, gives shine to hair
13	Coffee	dried ripe seeds of *Coffee arabica* linn	Rubiaceae	exfoliator to remove dead cells and promotes hair growth
14	Triphala	dried fruits of 3 species: amalaki, bibhitaki, haritaki	Phyllanthus emblica, terminalia bellerica, terminalia chebula	prevents premature graying and hair fall.

MATERIALS AND METHODS

Materials

Collection of herbs:

The various plant parts with hair-care properties were chosen for the study, and all of the herbal ingredients were collected from the botanical garden and Pharmacognosy Department of Gokaraju Rangaraju College of Pharmacy **(Figure 1)**. Then cleaned, and dried in the shade, ground into a powder, and then put through sieve number 85.

Test Microorganisms:

The microorganisms used for the study were the following:

1. Bacteria: a) Gram-negative- *Escherichia coli* and b) Gram-positive- *Staphylococcus aureus*
2. Fungi: *Candida albicans* and *Aspergillus niger*.

These microorganisms were obtained from the Microbiology Laboratory, Gokaraju Rangaraju College of Pharmacy, (GRCP).

Figure 1: Dried herbs for shampoo preparation

Procedure for Formulation of multipurpose Herbal shampoo [9]

Drying: Every powder has been ground and is in a dry state.

Weighing: Each of the herbal powders that were needed to make shampoo was weighed separately.

Size reduction: After gathering the raw materials, each one was individually size-reduced using a hand-cranked mixer.

Mixing: The mixer thoroughly combined all of these fine ingredients to create a uniformly fine powder.

Sieving: In order to obtain an adequate amount of fine powder, this powder was then passed through sieve No. 85.

Labeling and packing: After that, it was labeled and packed shown in **Figure 2**.

The quantity of all the ingredients was taken for 25g of Multipurpose Herbal Shampoo **[9]**.

Figure 2: Dried drug powder of herbal ingredients

Methodology

Various multipurpose herbal shampoos (F1, F2 and F3) were prepared using the required amount of all the herbal ingredients as mentioned in **Table 2**. Shampoo was prepared by following steps:

1. A decoction of Hibiscus, Neem, Tulsi, Curry Leaves, Amla, Alovera Gel, Orange Peel Powder, Onion Peel Powder, and Fenugreek powder was made by dissolving the weighed amount of dried herb into the one-part water.
2. A Shikakai and Reetha decoction was prepared in a different area of the water.
3. Pour both solutions through a muslin cloth to filter and gather the filtrate separately.
4. Filtrates were combined with continuous stirring.
5. Mixed Xanthum gum to make it semisolid and used as a thickening agent in herbal shampoos **[10-12]**.

Table 2: Formulation Composition of Poly Herbal Multipurpose Shampoos

S. No.	Ingredients	F1	F2	F3
1	Bhringraj powder	2.5g	2.5g	2.5g
2	Henna	1.25g	1.25g	1.25g
3	Lemon	1ml	0.8ml	0.5ml
4	Amla	2.5g	2.5g	2.5g
5	Reetha	2.5g	3g	3.5g
6	Neem	1.25g	1.5g	1.75g
7	Tulsi	2.5g	3g	3.5g
8	Green tea leaves	2.5g	2.5g	2.5g
9	Aloe vera	2.5g	2.5g	2.5g
10	Shikakai	0.25g	0.25g	0.25g
11	Orange peel powder	1g	0.8g	0.6g
12	Onion peel powder	1g	1g	1g
13	Fenugreek powder	2.5g	2.5g	2.5g
14	Black cumin seeds	1g	1g	1g
15	Coffee powder	1g	1g	1g
16	Hibiscus powder	2.5g	2.5g	2.5g
17	Curry leaves	1.5g	2.0g	2.5g
18	Triphala	2.5g	2.5g	2.5g
19	Gela n	1g	1g	1g
20	Castor oil	1ml	1ml	1ml
21	Tragacanth gum	0.5g	0.5g	0.5g
22	Coconut oil	1ml	1ml	1ml
23	Methyl paraben	0.05g	0.05g	0.05g
24	water	q.s	q.s	q.s

EVALUATION OF POLYHERBAL MULTIPURPOSE SHAMPOO

1. Characterization of powder content of polyherbal shampoo

Evaluation of the variables that will impact the preparation's external qualities, such as flow characteristics, appearance, packaging requirements, etc., is one of the general powder characteristics. Particle size, angle of repose, bulk density, and tapped density are the characteristics that were assessed for dry powdered crude herb. For this evaluation, each of the formulation compositions of powder of three shampoo formulations was taken from the top, middle, and bottom levels and subjected to Particle size, Angle of repose, Bulk density, and Tapped density **[13]**.

a) Particle size

The size of the particles was measured using I.P. Standard sieves and mechanical shaking for ten minutes,

b) Angle of repose

It is described as the greatest angle that can exist between the powder pile's surface and the horizontal flow. Funnel technique was used to determine the angle of repose of the powdered composition of all the shampoos.

Funnel technique

The necessary dried powder quality was measured in a funnel that was positioned 6 cm above a horizontal base. On the horizontal plane, the powder was let to run off the paper and accumulate into a mound. After noting and recording the powder's height and radius,

the formula can be used to determine the angle of repose (θ).

C) Bulk density

Bulk density is the relationship between a powder's mass and bulk volume. A 50 ml estimating chamber was filled to the 50 ml mark with the vital measure of powder that has been dried. The cylinder was then dropped from an inch above the ground twice every second onto a hardwood surface. The powder's volume was determined by measurement. The powder was weighed after that. This can be done again to get average values. The bulk density is determined using the formula below.

$$\text{Bulk density} = \frac{\text{Mass of herbal powder shampoo}}{\text{Volume of herbal powder shampoo}}$$

D) Tapped density

The "tapped density" is the increased bulk density that occurs when a powder sample is mechanically tapped into a container. After the initial powder volume or mass was observed, the measuring cylinder or vessel was mechanically tapped for one minute, and volume or mass readings were taken until a little more change in volume or mass was observed. G/cm3, or grams per cubic centimeter, was the metric system **[14]**.

$$\text{Tapped density} = \frac{\text{Weight of herbal shampoo powder}}{\text{Tapped volume of herbal shampoo powder}}$$

2. Visual examination

The polyherbal shampoos were evaluated for clarity, color, and odor, and results were noted.

3. pH determination

Each polyherbal shampoo was made into a 10% v/v solution, and the pH of each shampoo solution was measured at room temperature using a digital pH meter **[15]**.

4. Solid content percentage

To determine the percentage of solid substance, weigh about 4 g of shampoo in a dry and clean, dish that was evaporating. The procedure was repeated in order to confirm the result. The liquid shampoo portion vanished when the dish was placed on a heated plate. The weight and ratio of the solid components were determined once the shampoo had completely dried **[16]**.

5. Test for foam stability

The cylinder shakes method was utilized to ascertain the stability of the foam. A 250 ml measuring cylinder was filled with about 25 ml of shampoo, which was shaken for ten minutes. After one minute, the total volume of foam was measured, and the foam stability was ascertained by keeping track of the foam volume for four minutes.

6. Test for Skin Irritation

After washing, the skin was treated with a prepared polyherbal anti-dandruff shampoo

for five minutes, during which time the skin was checked for irritation or inflammation **[17]**.

7. Washability

Washability of the shampoos was observed by applying formulations to the skin allowed for manual evaluation of the degree and ease of water washing.

8. Solubility

A substance's ability to dissolve in a solvent is known as its solubility. Precisely weighed, one gram of the powder was added to a beaker filled with 100 ml of water. To improve the solubility, this was well-shaken and warmed. The residue that was obtained was weighed and recorded after it had cooled and been filtered.

9. Antimicrobial activity

A) Antibacterial activity

Using the conventional agar well diffusion method, the antibacterial activity of various formulations against both Gram-positive and Gram-negative bacteria was assessed. Agar medium was prepared and sterilized using an autoclave at 121 °C, 15lb pressure for 20 minutes. Sterilized molten agar media was inoculated with gram-positive bacteria (*Staphylococcus aureus)* and gram-negative bacteria *(E. coli*) separately by aseptic transfer under the laminar air flow bench. Immediately the inoculated agar media was poured into sterile petri plates and allowed for solidification. Using a sterile borer (8mm), wells were created on petri plates in the appropriate locations. The shampoos were applied into the wells and the petri plates were kept aside to allow the diffusion of the sample through the agar medium and incubated at 37 °C for 24 hrs in the incubator. After an incubation period, zones were measured in mm by a ruler for each well-exhibiting inhibition zone under and around a cup or well.

B) Antifungal activity:

Subouraud agar media was used for determining the antifungal activity for the developed formulations. Sabouraud agar media was prepared and sterilized using an autoclave at 121 °C, 15Lb pressure for 20 minutes. Sterilized the molten subouraud agar media was inoculated with Gram-positive fungi (*Candida albicans)* and Gram-negative fungi *(Aspergillus Niger*) separately by aseptic transfer under the laminar air flow bench. Immediately the inoculated Subouraud agar media was poured into sterile Petri plates and allowed for solidification. Using a sterile borer (8mm), wells were created on Petri plates in the appropriate locations. The shampoos were applied into the wells and the petri plates were kept aside to allow the diffusion of sample through the agar medium

and incubated at 25-28 °C for 24 hrs in the incubator. Zones were measured in mm by a ruler for each well-exhibiting inhibition zone under and around cup or well.

RESULTS AND DISCUSSION

1. Characterization of powder content of polyherbal shampoo

A) Particle size:

Using I.P. standard sieves and mechanical shaking for ten minutes, the particle size of the herbal powder was determined to be between 20 and 25 micrometers, according to microscopical studies.

B) Angle of Repose:

Angle of repose was calculated by using the funnel technique and the results are shown in **Table 3**. The angle of repose of all three herbal shampoos lies in the range of 21.65-21.80θ.

Table 3: Flow properties of powder contents of all the herbal shampoo

S. No.	Formulation Codes	Angle of Repose (θ)	Bulk Density (g/cm^3)	Tapped Density (g/cm^3)
1	F1	21.65	0.34	0.56
2	F2	21.70	0.33	0.54
3	F3	21.80	0.35	0.55

C) Bulk Density: Bulk density was calculated for the powder content of all herbal shampoos by using a formula and was found to be in the range of 0.33-0.35 g/cm^3 as shown in **Table 3**.

D) Tapped Density:

Tapped density was calculated for the powder content of herbal shampoo by using a formula and reported as 0.54-0.56g/cm^3 as shown in **Table 3**.

2 Visual Examination:

The visual evaluation was performed visually for all the developed herbal shampoo formulations. All the shampoos were observed in brown color and had a pleasant odor with a smooth texture and slightly viscous **(Figure 4)**.

Figure 4: Prepared polyherbal shampoo formulations

3. pH Test:

pH was observed using a pH meter **(Figure 5)** for all developed shampoo formulations and it was found within the range of 4.73-5.91 as shown in **Table 4**. It was in the range of scalp pH and all the formulations had good pH values.

Figure 5: pH measurement of herbal shampoos using pH meter

Table 4: pH and Foaming index of Multipurpose herbal shampoo

S. No.	Formulation Codes	pH	Foaming Index
1	F1	4.86	666
2	F2	5.34	500
3	F3	5.83	400

4. Solid Content Percentage:

The percentage of solid content was determined by taking the ratio of the initial weight of the Petri-dish and sample to the final weight of the petri dish and sample which was evaporated. The solid contents of the three shampoos were reported in the range of 27.3 to 30 as shown in **Table 5**.

5. Foaming index:

The foam in each test was measured in cm and the foaming index was calculated using formula 1000/A, where A is the volume of decoction having an exact 1cm height and results were shown in table 6 and fig 6. The foaming index of three developed herbal shampoos was observed in the range of 400 to 666 as shown in **Table 6**.

6. Test for skin irritation:

An irritancy test was performed by applying cream to the sensitive area of the skin and left for 24hrs and it was observed that there were no irritant effects, erythema, and edema observed after application of any formulation at the end of the 24hrs.

Table 5: Percentage of solid content of herbal shampoo

S. No	Formulation Codes	Weight of empty petri dish (gm)	Weight of empty petri dish with sample (gm)	Weight of empty petri dish with sample after evaporation (gm)	Percentage of solid content
1	F1	30	33	32.1	30
2	F2	30	33	32.15	28.3
3	F3	30	33	32.18	27.3

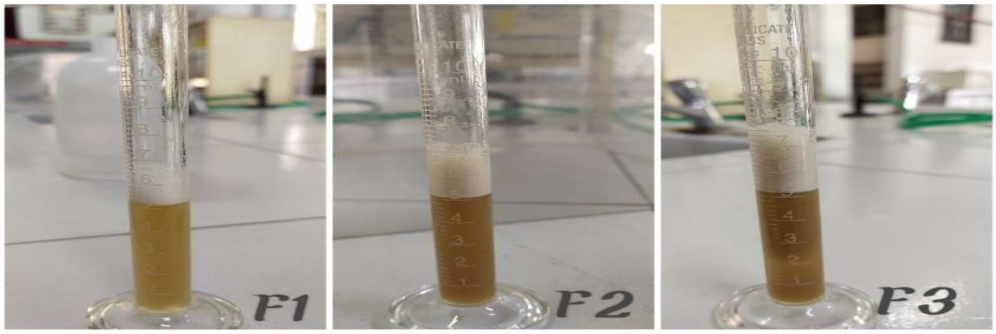

Figure 6: Foaming index determination of polyherbal shampoo

7. Washability:

Washability was determined by applying formulations to the skin allowing for manual evaluation of the degree and ease of water washing and results were shown in **Table 7**. All herbal shampoos are easily washable.

8. **Solubility:**

The solubility of herbal shampoo was determined as soluble in water and results are shown in **Table 7** and found that all shampoos were easily soluble in water.

Developed polyherbal shampoo formulations were compared with the marketed formulation and the results were displayed in table 8. It was observed that all developed polyherbal shampoos are showing better results in terms of solid content and foaming index as compared to marketed shampoo as shown in **Table 8**.

Table 7: Washability and Solubility of herbal shampoo

S. No.	Formulation codes	Washability	Solubility
1	F1	Yes	Soluble in water
2	F2	Yes	Soluble in water
3	F3	Yes	Soluble in water

Table 8: Comparison of prepared polyherbal shampoo with marketed shampoo

S. No.	Parameters	F1	F2	F3	Marketed shampoo
1	Color	Brown	Brown	Brown	Light brown
2	Odor	Good	Good	Good	Good
3	pH	4.86	5.34	5.83	5.75
4	Appearance	Brown	Brown	Brown	Light brown
5	Percentage Solid content	30	28.3	27.3	33.3
6	Foaming index	666	500	400	333

9. Antimicrobial activity:

Antimicrobial activity was performed for developed herbal shampoo using gram-positive bacteria (*Staphylococcus aureus*) and gram-negative bacteria *(E. coli)* and by using fungus strains *Candida albicans* and *Aspergillus niger* using agar well diffusion method and zone of inhibition was measured as shown in **Table 8**. Antibacterial activity was performed with marketed shampoo and

results are shown in **Table 8**. It was found that F3 showed a good zone of inhibition compared with other formulations such as F1 and F2.

Among all the polyherbal shampoos, the F3 formulation displayed the highest zone of inhibition against bacteria and fungi as compared to the F1 and F2 formulations. The zone of inhibition was higher i.e. 12.5 mm in the case of gram-negative (*E. coli*) as compared to gram-positive bacteria (*S. aureus*, 11.2mm) as shown in **Table 9 and Figure 7**.

Similarly, the F3 formulation displayed higher zone of inhibition in the case of *Candida albicans* (Gram-negative) than in *Aspergillus niger* (Gram-positive) as shown in **Table 9 and Figure 8**.

The zone of inhibition of the F3 formulation is very close to that of a marketed formulation in the case of bacteria. Whereas F3 formulation shows a higher zone of inhibition in the case of fungi in comparison to marketed shampoo as shown in **Table 9** and **Figure 8**, **9**.

Table 9: Antibacterial and antifungal activity of developed polyherbal shampoo and marketed shampoo

Microorganisms	Zone of Inhibition(mm)			
	F1	F2	F3	Marketed shampoo
Bactria				
E. coli	11.2	12.0	12.5	13.5
Staphylococcus aureus	10.4	7.6	11.2	11.2
Fungus				
Candida albicans	16.4	15.2	17.1	8.6
Aspergillus Niger	10.2	9.3	14.2	10.3

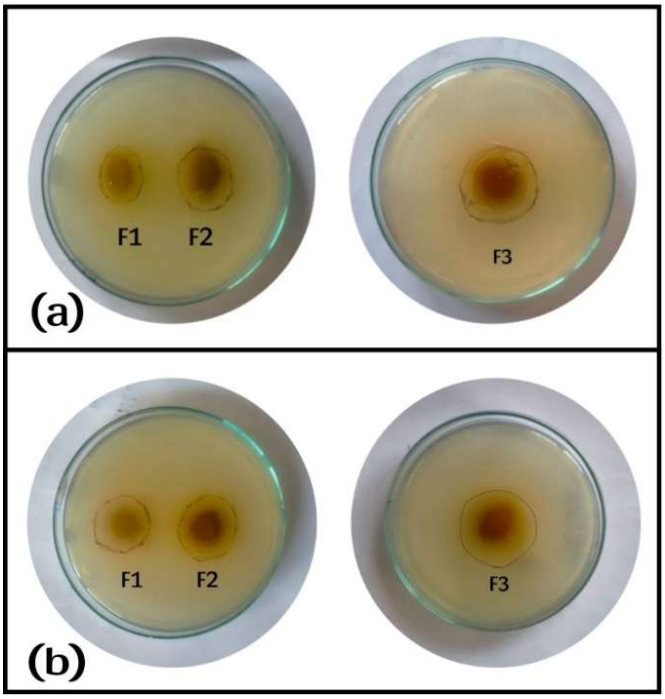

Figure 7: Zone of inhibition against a) Staphylococcus aureus (Gram-positive bacteria); *E.coli* (Gram-negative bacteria)

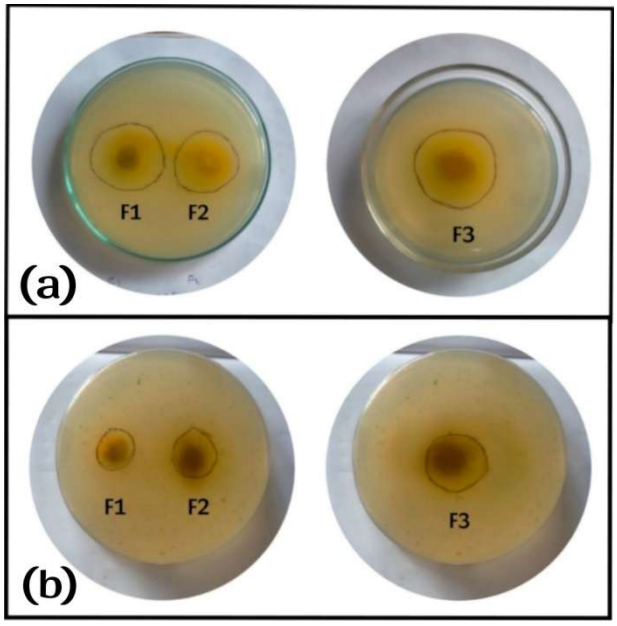

Figure 8: Zone of inhibition against a) *Candida albicans* (Gram-positive); b) *Aspergillus niger* (Gram-negative)

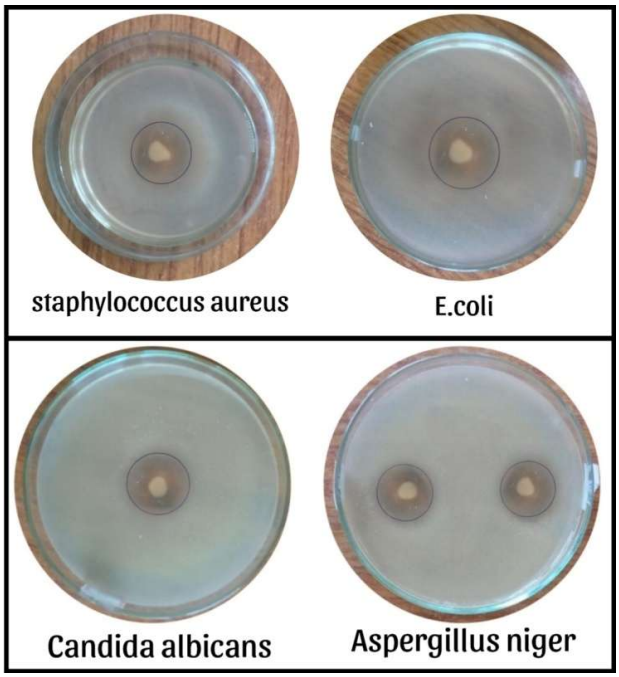

Figure 9: Zone of inhibition of Marketed shampoo

10. Stability studies

Stability studies were carried out for one month at room temperature and pH, appearance, and sedimentation were recorded after one month. All the formulations were found to be stable at the end of the storage period as shown in **Table 10**.

Table 10: Stability studies at Room Temperature for one month

S. No.	Formulation codes	pH	Appearance	Sedimentation
1	F1	4.86	No change	No sedimentation
2	F2	5.34	No change	No sedimentation
3	F3	5.83	No change	No sedimentation

CONCLUSION

Multipurpose herbal shampoos were successfully developed by using all herbal ingredients and evaluated to various parameters such as color, odor, appearance, pH, solid contents, foaming index, washability, solubility, and antimicrobial activity. All developed shampoos show desired properties and have good antimicrobial action. Among all, the F3 formulation displayed better results as compared to other F1 and F2 formulations. All the polyherbal shampoos were stable at room temperature and could be safely used on the hair. In comparison to marketed shampoo, the F3 formulation depicted better results.

CONFLICT OF INTEREST:

No conflict of interest regarding the publication of this manuscript.

ACKNOWLEDGEMENT

The authors would like to sincerely thank the Principal, Gokaraju Rangaraju College of Pharmacy, Dr. M. Gangaraju sir for providing all the excipients and proper facilities that are required for formulation. The authors are also thankful to Dr. Gyati Shilakari Asthana mam for providing consistent support and timely guidance.

REFERENCES

[1] Waghmode Monika Vasant, Hingane L. D. Formulation and Evaluation of Herbal Shampoo. International Journal for Research in Applied Science & Engineering Technology. 2022 Jun 27; 10(4): 3774-3781. doi:10.22214/2022.44982

[2] Priya D. Gaikwad, Kamini V. Mulay, Madhavee D. Borade. Formulation and Evaluation of Herbal Shampoo. International Journal of Science and Research. 2018 Mar: 9(3): 29-31. doi: 10.21275/ART20203315

[3] Barve Apurva Babasaheb *et al*. Formulation and Evaluation Of Polyherbal Shampoo. Journal of Emerging Technologies and Innovative Research. 2022 Jun; 9(6): 768-781.

[4] Ashwini Sukhdev Pundkar and Sujata P. Ingale. Formulation and evaluation of herbal liquid shampoo. World Journal of Pharmaceutical Research.

2020 Feb 25; 9(5): 905-911. doi: 10.20959/wjpr20205-16967.

[5] Khaloud Al Badi, Shah A. Khan. Formulation, evaluation and comparison of the herbal shampoo with the commercial shampoos Beni-suef university journal of basic and applied sciences. 2014 Dec 10; 3(4): 301-305. doi:10.1016/j.bjbas.2014.11.005

[6] Kancharla. Kameswararao, B. Lakshmiprasanna, M. Aparnadevi, G. Nagadevi, S. Rajeswari. Formulation and Evaluation of Polyherbal Shampoo. International journal of pharmacy and pharmaceutical research. 2018 Aug 30; 13(1): 251-268.

[7] Khandagale Sandip *et al*. Formulation and Evalution of Herbal Neem Anti-dandruff Shampoo. International Journal of Ayurveda and Pharma Research. 2022 December 22; 10(12): 36-41. doi: 10.47070/ijapr.v10i12.2471

[8] Jyoti Gahlawat *et al*. Formulation and Evaluation of Polyherbal Liquid Shampoo. European Journal of Biomedical and Pharmaceutical sciences. 2019 Jun 24; 6(7): 149-154.

[9] M. Surya Prabha *et al*. Formulation and Evaluation of Herbal Hair Powder against Dandruff. Int. J. Pharm. Sci. Rev. Res. 2014 Jul 30; 28(2): 43-47.

[10] Rupesh Rathore *et al*. Gupta. Preparation and Evaluation of Powdered Herbal Shampoo Using Bhirngraj. IJPLS. 2019 May 28; 10(5): 6275-6279.

[11] Kundkar Shraddha *et al*. Formulation and Evaluation of Polyherbal Shampoo. International journal of pharmacy and pharmaceutical research. 2021 Jul 30; 21(4): 296-312.

[12] Manali V. Gharat, *et al*. Formulation and Evaluation of Herbal Shampoo. International Journal of Advanced Research in Science, Communication and Technology. 2022; 2(5): 217-222. 10.48175/IJARSCT-47611

[13] Khandelwal, KR"Practical Pharmacognosy Techniques &Experiment", Nirali Prakashan.2008;19:102,106.

[14] Sachin Gholve *et al*. Formulation and Evaluation of Polyherbal Antidandruff Powder Shampoo. WJPR. 2015 Sep 13; 4(10): 1714-1731.

[15] Milind Dyagatwar *et al*. Development and Evaluation of Herbal Shampoo as an Antifungal Formulation. IJDDT. 2023 Sep 25; 13(3): 913-918. doi:10.25258/ijddt.13.3.23.

[16] Monika Vinchu *et al*. A Review on Formulation and Evaluation of Herbal Shampoo. International Journal of Creative Research Thoughts. 2022 Nov; 10(11): 396-400.

[17] Sonali S Gadge *et al*. Formulation and evaluation of polyherbal antidandruff shampoo. Journal of Pharmacognosy and Phytochemistry. 2023 Jun 18; 12(4): 35-41. doi:10.22271/phyto.2023.v12.i4a.14691.